SCH 3U EXAM REVIEW

Exam Date: _____
Time:_____
Location: _____
What to bring: Students are responsible for the following. Students are not permitted to share calculators

- ❑ Textbook – Nelson Chemistry 11
- ❑ pencil/pen (I recommend using pencil - you might want to bring a small sharpener! If you use pen bringing whiteout is highly recommended!)
- ❑ calculator (Scientific Calculator recommended)

What NOT to bring:

- ❑ ipod or any other electronic device other than a calculator
- ❑ cell phone

What is provided: SCH3U Data Sheet Ver C - This contains all of the information provided on Unit Tests. It is recommended that Students complete this Review Package with the Data Sheet.

DISCLAIMER! This review package is just ONE of the numerous steps you should be taking to prepare for the final exam. There could be other topics that are not covered in this review package that will be on the exam.

Unit 1: Matter and Bonding

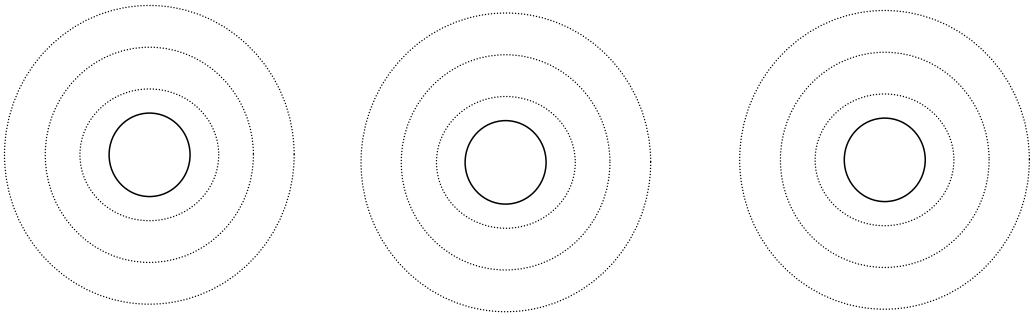
1. Define atomic number and mass number. Consider the element Bromine. What is its atomic number? Mass number? Number of protons, neutrons and electrons.

2. Fill in the following Table:

Symbol	p^{1+}	n^0	e^{1-}	Symbol	p^{1+}	n^0	e^{1-}
H^+					12		10
$^{12}_{6}C$				As^{3-}			
$^{7}_{3}Li^{1+}$					92	143	
$^{35}_{17}Cl^{1-}$					8		10
$^{39}_{19}K$							17
$^{24}_{12}Mg^{2+}$				Ag^{1+}			

3. Complete the following Bohr-Rutherford Diagrams (you'll need more energy levels for the barium!)

$^{22}_{10}Ne$ $^{10}_{5}B^{3-}$ $_{56}Ba$



4. What are isotopes? Magnesium 24, 25 and 26 are isotopes. How many protons, neutrons and electrons does each isotope have?

5. What is a radioisotope? What is meant by the term half-life? State 2 beneficial uses of radioisotopes.

6. Distinguish between alpha decay and beta decay.

7. Predict the products of alpha decay of ^{27}Al

8. Predict the products of beta decay of ^{42}K

9. Define the term valence electron. Draw a Lewis dot diagram for nitrogen, beryllium, and neon.

10. What is the meaning of effective nuclear charge? How does the effective nuclear charge felt by the outer electrons vary going down a group? How does it change as we go from left to right across a period?

11. Define the following terms: atomic radius, ionization energy, electron affinity, and electronegativity. Explain what happens to each trend when you move across the periodic table within a row and when you move down a group.

12. Choose the larger atom in each pair: (a) Na or Si; (b) P or Sb.

13. Distinguish between an ionic and a covalent bond. Draw Lewis dot diagrams to represent the bonding in aluminum chloride and calcium oxide. What type of bonds are these?

14. Draw Lewis dot diagrams representing the bonds in NH_3 , H_2O and C_2H_2 . What type of bonds are these?

15. What is a polar covalent bond? Explain why hydrogen chloride has a polar bond.

16. Describe the three types of intermolecular forces: dipole-dipole forces, London dispersion forces and hydrogen bonds.

17. Using the IUPAC names below, determine the correct chemical formula:
    a. Ammonium borate
    b. Potassium phosphate
    c. tin (IV) chloride
    d. hydrobromic acid
    e. Sodium monohydrogen phosphate
    f. perchloric acid
    g. Hydrogen peroxide
    h. silver iodide
    i. diphosphorus pentaoxide
    j. nitrous acid
    k. calcium hydroxide
    l. dihydrogen monoxide

18. Give the Correct IUPAC names for the following molecular formulas.
    a. $(NH_4)_2CO_3$
    b. MnO
    c. $CuCl_2$
    d. $HI_{(aq)}$
    e. $HClO_{4\,(aq)}$
    f. N_2O
    g. $HNO_{(aq)}$
    h. $Ca(OH)_2$
    i. $(NH_4)_2Cr_2O_7$
    j. Al_2O_3

Unit 2: Chemical Reactions

1. Identify the five pieces of evidence that there are that give chemists clues that a chemical reaction has occurred.

2. A student observed bubbles forming with a bunsen burner is placed underneath a beaker filled with an unknown liquid – is this a chemical reaction? Explain.

3. For each of the following equations, balance it and identify the type of reaction:
    a) ___Zn + ___S_8 → ___ZnS _____
    b) ___$KClO_3$ → ___KCl + ___O_2 _____
    c) ___Mg + ___HNO_3 → ___$Mg(NO_3)_3$ + ___H_2 _____
    d) ___K_2SO_4 + ___NH_4NO_3 → ___KNO_3 + ___ $(NH_4)_2SO_4$ _____

4. Write each of the following as a balanced equation.

    a. Iron can be produced from iron ore, Fe_2O_3, by reacting the ore with carbon monoxide, CO. Carbon dioxide is also produced.

    b. Sodium hydroxide or caustic soda, $NaOH$, used in many household drain cleaners, can be prepared by the reaction of calcium hydroxide, $Ca(OH)_2$, with sodium carbonate, Na_2CO_3. Calcium carbonate, $CaCO_3$ is also formed in this reaction.

c. Lead(II) chloride reacts with sodium chromate to form a precipitate of lead(II) chromate and another product.

d. You may have seen the thick haze commonly found over highly industrial areas. One of the substances responsible for this is ammonium sulphate, $(NH_4)_2SO_4$, which forms in the air by the reaction between ammonia, NH_3, and sulphuric acid, H_2SO_4.

5. Show the reactions needed to create $LiOH_{(aq)}$ from solid lithium.

6. Use your activity series to predict the following single displacement reactions.
   - If the reaction occurs, write the balanced chemical equation.
   - If a reaction does not occur write "NR" as the product.
   a) ___Al + ___$Pb(NO_3)_2$ →
   b) ___Cl_2 + ___NaI →
   c) ___$AgC_2H_3O_2$ + ___Zn →
   d) ___Zn + ___$AlCl_3$ →
   e) ___Br_2 + ___CaF_2 →
   f) ___Cu + ___HCl →

7. How can you create acids and bases from elements on the periodic table? What reactions must be performed? What controls whether an acid or a base is formed?

Unit 3: Quantities in Chemical Reactions

1. What is the mole? Why is it important for chemists?

2. What is Avogadro's number?

3. Calculate the molar mass of C_6H_{12} and $Pb(NO_3)_3$

4. Isotopic abundance: Lithium consists of 2 isotopes in these proportions 92.5% ^{7}Li atomic mass 7.016u and 7.5% ^{6}Li atomic mass 6.015u. Calculate the average atomic mass of Lithium.

5. Empirical and Molecular formula: A compound of carbon, chlorine and fluorine was found in an air conditioning unit. The compound was analyzed and found to contain 16.3% carbon; 32.1 % chlorine and 51.6% fluorine by mass. Determine the empirical formula of the compound. What is the molecular formula if the molar mass of the compound is 442 g/ mol?

6. Percentage Yield: In an experiment, 10 g of sugar produces only 0.664 g of ethanol, yet the theoretical yield is 5.11g. Calculate the percentage yield.

7. Percentage Composition: Calculate the percentage by mass of each element in Na_2SO_4.

8. MOLE problems
   a. A balloon is inflated with 0.5 mol of He atoms. How many He atoms are in the balloon?
   b. Calculate the number of moles of oxygen atoms in 1.2×10^4 molecules of oxygen gas.
   c. If 3.5 moles of H_2O_2 are used in an experiment determine the mass of the H_2O_2 used.
   d. Calculate the number of moles of 225 g of aspirin, $C_9H_8O_4$.

9. Mole to Mole problems:
   Consider the equation: $2\ CH_3OH + 3\ O_2 \rightarrow 2\ CO_2 + 4\ H_2O$
   If 3.5 moles of methanol are burned in a plentiful supply of oxygen then
   a) How many moles of oxygen are used?
   b) How many moles of H_2O are produced?

10. Mass to Mole problems:
   Consider the equation: $C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$
   a) What mass of oxygen is required to react with 1200 g of ethanol?
   b) If 6.55 g of water is produced, what mass of ethanol is burned?

11. Limiting reagent problems:
Aluminum reacts with bromine to form aluminum bromide $2Al + 3Br_2 \rightarrow 2AlBr_3$
If 15.8 g of Al and 55.6 g of Br_2 are available for reaction, determine
   a) the limiting reagent
   b) the mass of $AlBr_3$ produced.

Unit 4: Solutions

1. Explain these key ideas: a) "Like dissolves like" b) water is the "universal solvent."
2. Some terms to know: solute, solvent, solution, saturated, unsaturated, supersaturated, concentrated, dilute, solubility, Arrenhius acid and base, Bronsted-Lowry acid and base, strong versus weak acid and base, pH scale, titration, endpoint.
3. Solubility rules: predict the products of the reaction, including the state of matter. Write a word equation and a chemical equation.
   a. lead nitrate + potassium iodide
   b. ammonium sulfate + calcium chloride
4. Total and Net Ionic Equations: In a water treatment plant, sodium phosphate is added to remove calcium ions from the water. Write the net ionic equation for the reaction of aqueous calcium chloride and aqueous sodium phosphate.
5. Concentration of solutions: key formula: moles = Molarity x volume and
6. Concentration (Molarity) = $\frac{\text{\# moles}}{\text{Volume in L}}$
   a) How many moles of NaCl are needed to make 500 mL of a 0.75 mol/L salt solution?
   b) What mass of sodium chloride is required to make the solution in part a)
   c) Calculate the molarity of a solution when 0.55g of HCl is dissolved in water to make 3.0 L of solution.
7. Making solutions:
   a. From solids: Describe how (including all calculations) you would make 200mL of a 0.1 M sodium chloride solution.
   b. From liquids: Use the dilution formula $C_1V_1=C_2V_2$
8. Describe how you would make 100 mL of 0.25 M HCl from a 0.5 M stock solution.
9. Solution stoichiometry: Calculate the mass of zinc that will completely react with 250 mL of a 2.0 M HCl solution.
   Use the equation $HCl + Zn \rightarrow ZnCl + H_2$ (Did you balance it?)
10. Calculate pH: rainwater has a $[H^+] = 2.3 \times 10^{-6}$ mol/L, calculate its pH the pH of milk is 6.5, calculate the $[H^+]$
11. Titrations: if 20 mL of hydrochloric acid of unknown concentration requires 35 mL of a 0.25 mol/L sodium hydroxide solution to reach the endpoint in a titration, calculate the concentration of the hydrochloric acid solution.

Unit 5: Gases

1. Describe the Kinetic Molecular Theory in detail.
2. Convert the following:
   a. 0.875 atm to mmHg b. 0.955 atm to kPa c. 740 mmHg to kPa
3. Write out the equations for Boyle's Law, Charles' Law, Gay-Lussac's Law, Combined Gas Law, and Ideal Gas Law, Dalton's Law of partial pressures, and Molar volume
4. Boyle: the pressure on 15 L of gas is increased from 80 kPa to 320 kPa. Calculate the new volume of the gas, assuming constant temperature.
5. Charles: if 50mL of gas in a syringe at 15°C is heated to 50°C, calculate the new volume of the gas, assuming constant pressure.
6. Gay-Lussac: on a day when the temperature is 19°C, a car tire has a pressure of 190 kPa. After several hours of driving, the temperature has risen to 29°C. What is the new tire pressure assuming constant volume?
7. Combined Gas Law: a mass of gas occupies a volume of 500 mL at a pressure of 150 kPa and a temperature of 10°C. What will the new pressure be if the volume is increased to 580 mL and the temperature to 28°C?
8. Ideal Gas Law: calculate the volume that 6.3 moles of carbon dioxide gas at 23°C and 550 kPa pressure will occupy.
9. Molar volume: determine the number of moles of 95 L of oxygen gas at STP.
10. Gas stoichiometry: Acetylene (C_2H_2) gas is prepared in the laboratory by reacting calcium carbide (CaC_2) with water. Calcium hydroxide is also a product. Determine the mass of calcium carbide that is required to produce 250 mL of gas at STP.